EXPLORER Product demonstration prop building instructions

For companies attending an EXPLORER class regional event, regional competitions may build product demonstration props out of materials other than PVC pipe. Your regional coordinator will inform you of any changes to materials for your regional competition. NOTE: Look for a regional information document posted on your regional website. This document will list any changes to the product demonstration props.

Companies should be aware that tolerances in lengths of cut pipe and length of pipe inserted into joints can change the overall dimensions of product demonstration tasks. Except where noted, companies should expect tolerances in all product demonstration props and should build their ROVs and tools accordingly. In no case should the dimensions given in this document for a product demonstration prop be used to calibrate a measuring device.

Online links and Home Depot part numbers are given for certain construction items. However, some Home Depot stores may not carry the listed items or Home Depot may not be available in your area. MATE recommends checking other local hardware stores or online sources, such as those listed below, for the required component.

https://www.pvcfittingsonline.com/
https://pvcpipesupplies.com/pvc-fittings/schedule-40-pvc-fittings/

SolidWorks files will be available soon for all product demonstration props. SolidWorks Student Edition is free for MATE competitors. The eDrawings Viewer is a free download that allows the Solidworks files to be viewed dynamically.

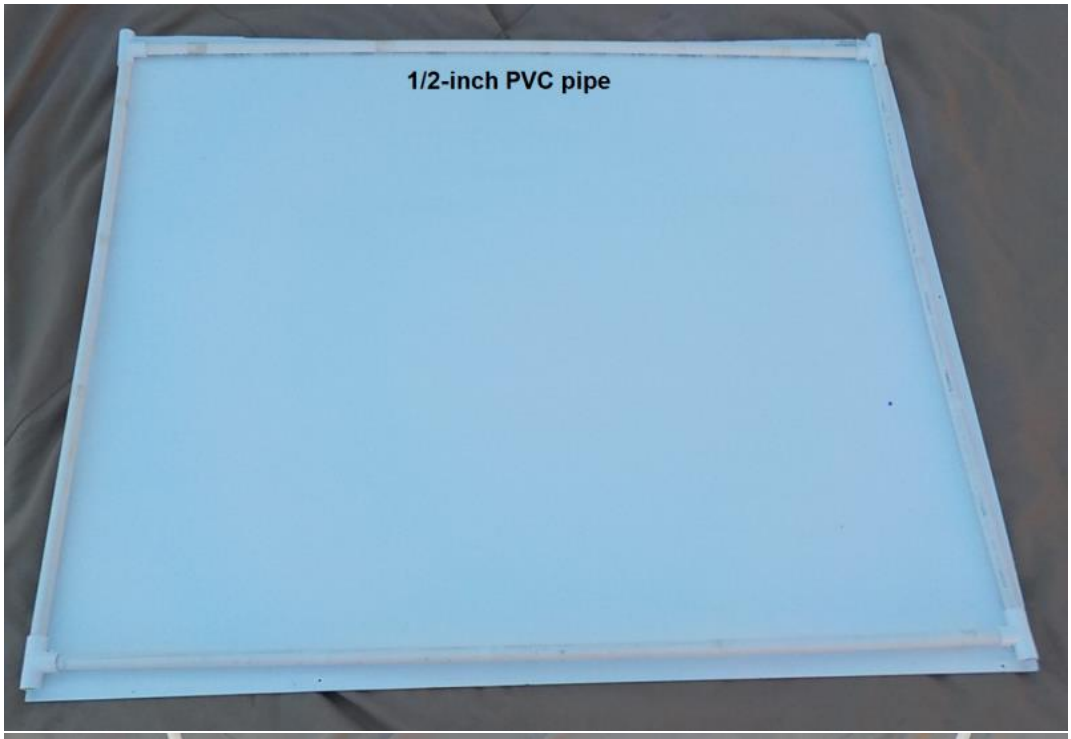
See last page for update notes.

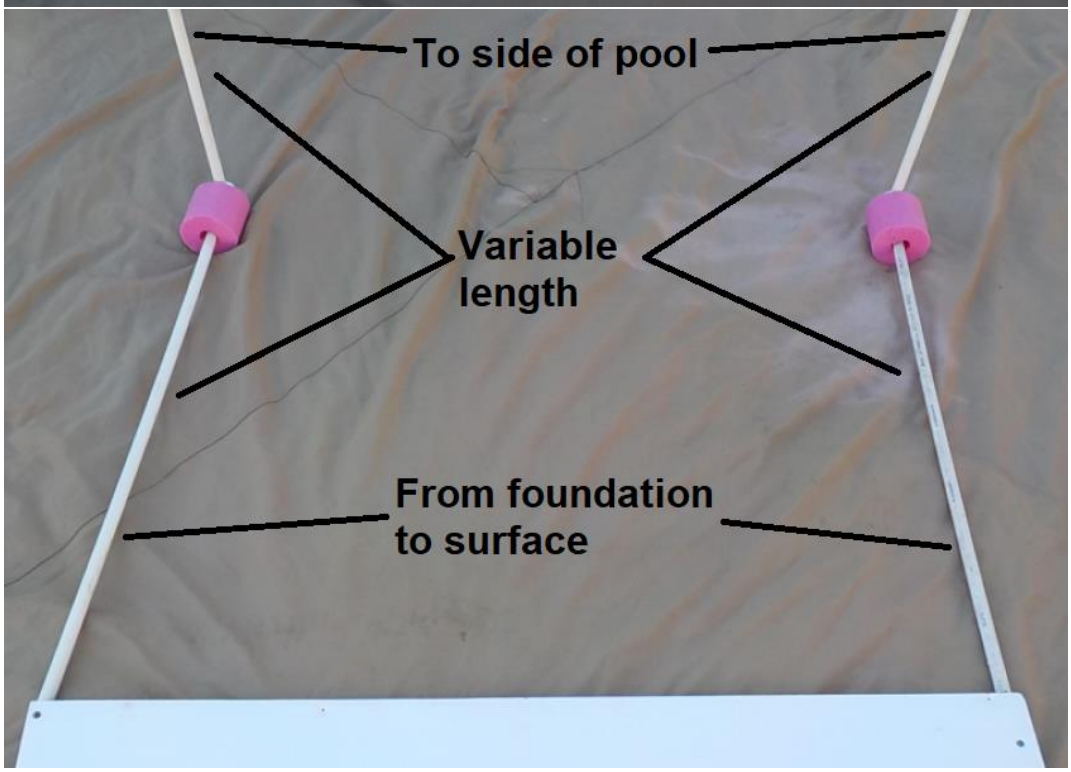
Task 1: Dam Inspection and Repair

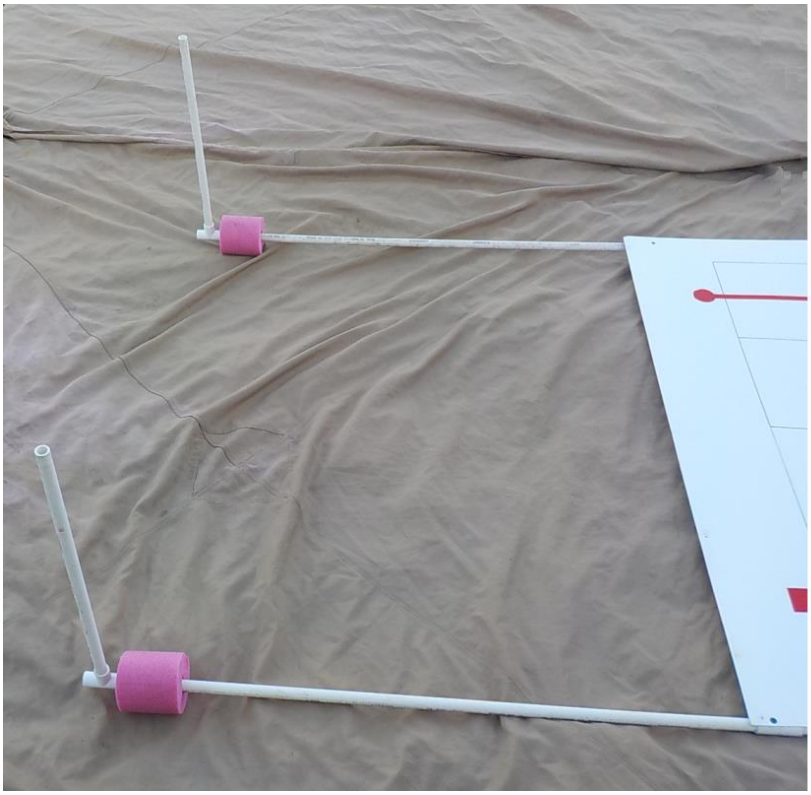
Foundation of the dam:
The foundation of the dam is simulated by a corrugated plastic sheet. Check sign stores for corrugated plastic sheeting. The sheet will be suspended vertically in the water column on a framework of ½-inch PVC pipe. The corrugated plastic sheet will be set at a distance of 1.25 meters to 1.5 meters from the pool wall.

During the competition, the ½-inch PVC pipe will extend approximately 1.25 meters from the surface, side of the pool then turn at a right angle and descend into the pool at least 0.5 meters. This pipe is attached to the ½-inch PVC framework. Weights on the surface, side of the pool will secure the PVC in place. Flotation at the 90° bend into the pool will stabilize the sheet. The lengths of the pipe will vary depending on the distance from the side of the pool and depth of the corrugated plastic.

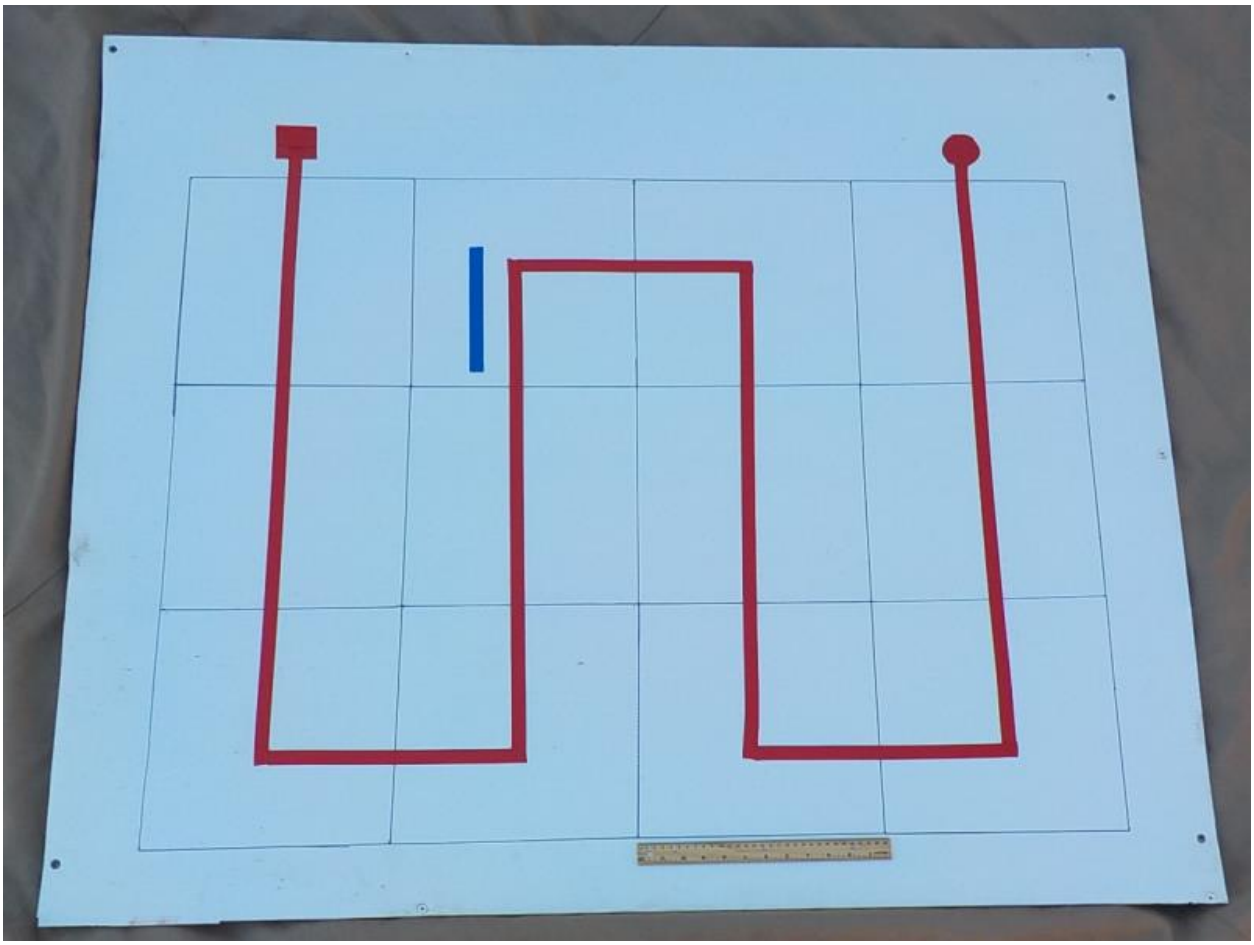
The PVC framework is attached to the one side of the corrugated plastic sheeting. The lengths of ½-inch PVC pipe of the framework will vary depending on the size of the corrugated plastic. The framework should be 1 cm to 2 cm inside the corrugated plastic sheet and attached to the sheet with screws.







Twelve squares arranged in a 4 x 3 grid are located on the side of the plastic sheet facing the pool wall. The squares will be 30 cm x 30 cm in each dimension and drawn with black markers. A red line transects all twelve squares. One end of the red line has a red circle approximately 4 cm in diameter. The other end of the line has a red square approximately 4 cm in size. The red line, circle, and square are created with red electrical tape. The red plastic tape is 1.8 to 1.9 cm wide.



One blue line on the grid represents a crack in the dam. The blue line is created with blue electrical tape and will be 1.8 cm to 1.9 cm in width and 8 cm to 20 cm in length. The crack will be located entirely within a black grid square, and will be parallel to, but not touching the red line.

Grout:

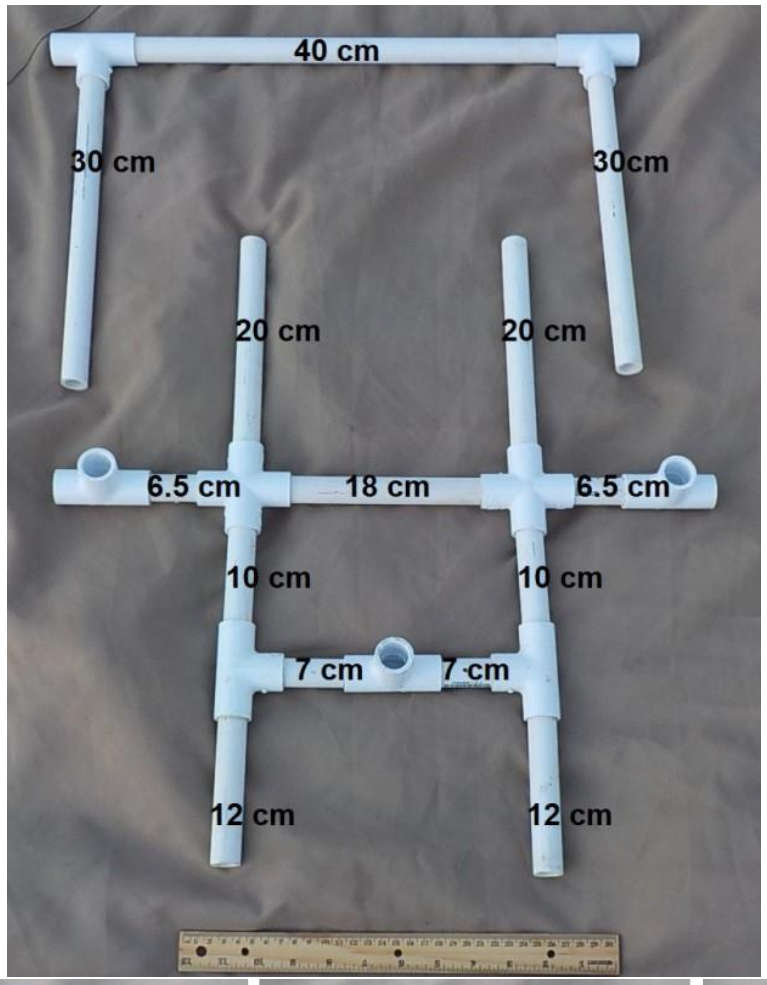
Grout is simulated by ½-inch to 1-inch Black Mexican Beach Pebbles. Note that rocks listed as ½-inch to 1-inch may be significantly larger than 1-inch in size.

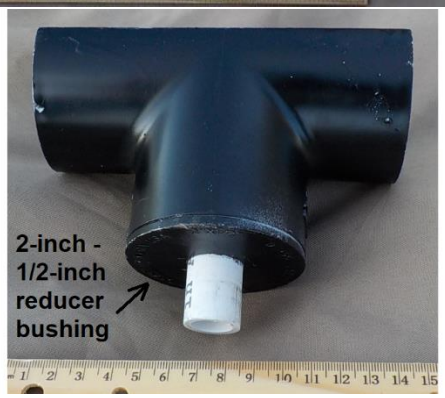
Void:

The void is constructed from a red plastic cup (check grocery and other stores) attached to a small corrugated plastic sheet attached to a ½-inch PVC framework. A black line is drawn with a marker on the inside of the cup, 4 cm to 5 cm from the bottom.

Design note: The void is identical to the agar container from the 2017 MATE ROV Competition.

Trash rack:
The trash rack is constructed from ½-inch PVC pipe. One 2-inch tee cut lengthwise acts as a cradle for the bottom edge of the trash rack screen. A 2-inch to ½-inch reducer bushing connects the 2-inch tee to the ½-inch framework.

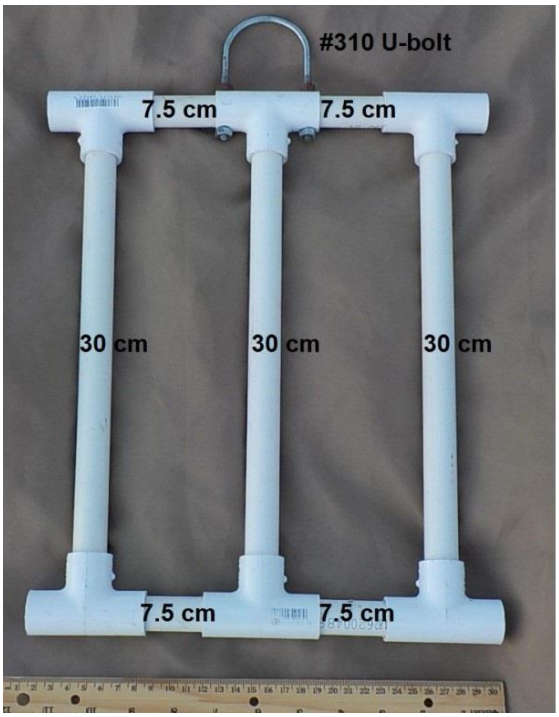


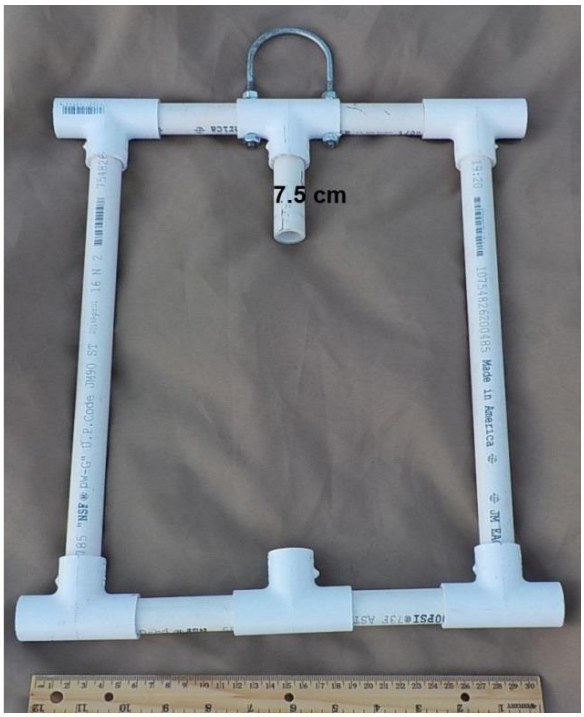


Design note: A cradle section of the 2018 I-AMP is used for the 2019 cradle on the trash rack.

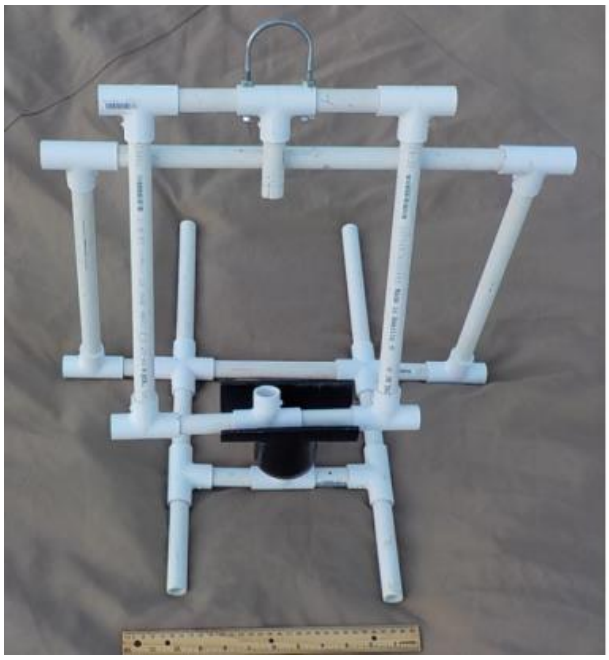
Trash rack screens:

Both the damaged trash rack screen and the new trash rack screen are the same with the exception of the center length of PVC pipe. The screens are constructed from ½-inch PVC pipe with a #310 U-bolt on top. The center vertical section of PVC pipe is shorter on the damaged trash rack screen.





Left: New trash rack screen.
Right: Damaged trash rack screen.




Left: Damaged trash rack screen on trash rack.
Right: New trash rack screen on trash rack.

Drain pipe:

The drain pipe is constructed out of a 10 foot length of 6-inch Corex drain pipe. The Corex drain pipe will be perforated. Note: the Corex pipe link provided in the manual links to solid 6-inch Corex pipe, but

perforated Corex pipe will be used. Corrugated plastic sheeting covers one end of the 6-inch pipe. It is secured in place with cable ties. 19 cm x 9 cm x 5.5 cm red bricks and/or ½-inch PVC pipe is used to keep the drain pipe from moving on the pool bottom.

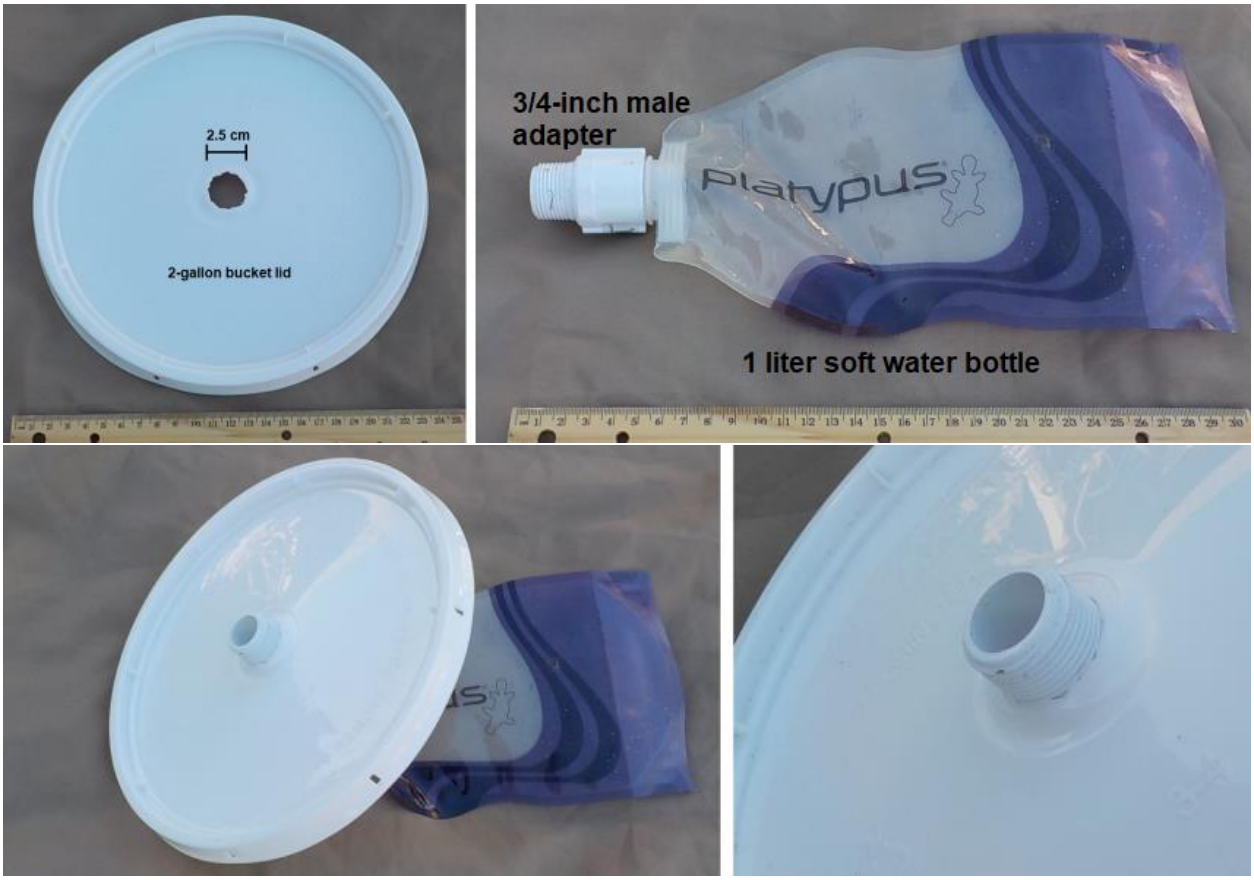
The muddy water flow is simulated by 7 cm long strands of brown foam sheeting placed inside the pipe. The muddy flow will be less than 30 cm from the end of the pipe and secured inside the pipe with a screw.

Photo on right note: In water, the ends of the foam sheeting will float up in the water column.

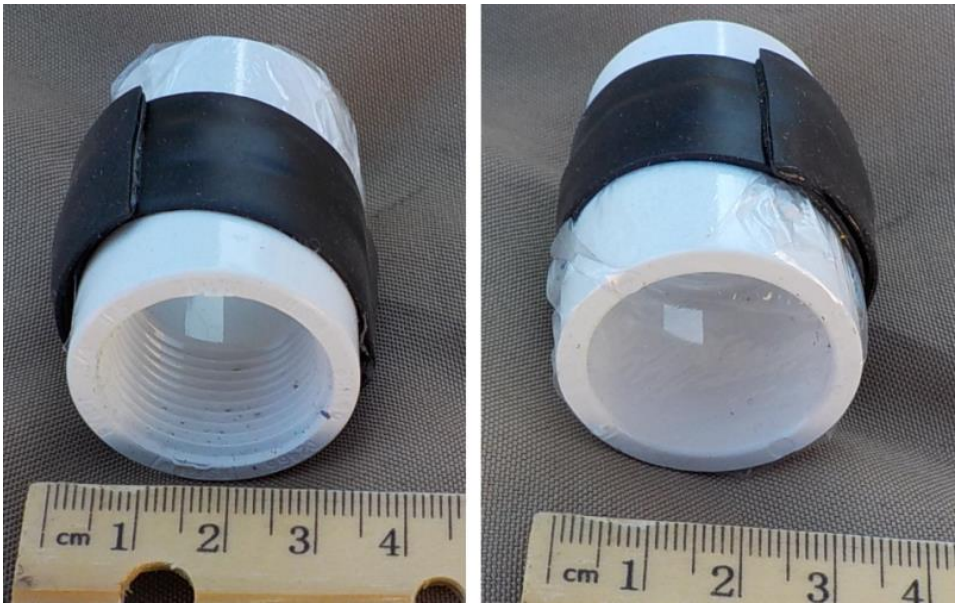
Task 2: Maintaining Healthy Waterways

Temperature sensor:
Companies are required to provide their own sensor to measure temperature. The MATE ROV Competition will not provide one.

Water sample:
The water sample is constructed from a 1.0 liter Platypus soft-walled water bottle, ¾-inch PVC connectors and a 2-gallon bucket. The sample will be located within the soft-walled water bottle and can be accessed through the ¾-inch PVC connectors. The connectors will penetrate through the lid of the 2-gallon bucket. A thin layer of plastic wrap will keep the sample from mixing with the pool water.

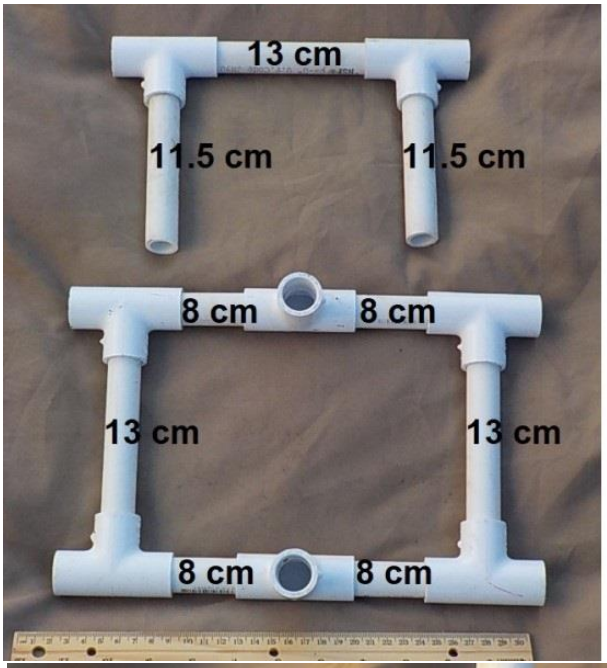


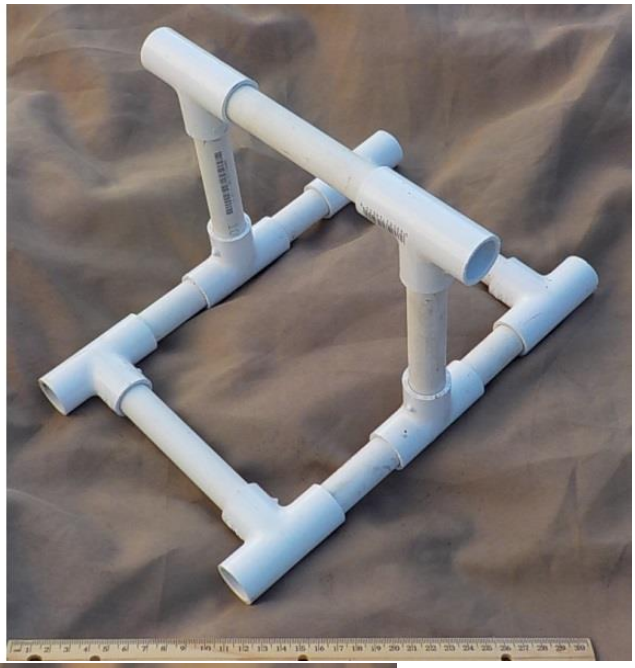
The bottle and PVC will be filled with the sample liquid. A ¾-inch PVC female adapter is screwed on to the male adapter. A thin layer of plastic wrap will cover the slip end of the female adapter. 1-inch moisture sealing electrical tape will keep the plastic layer in place.

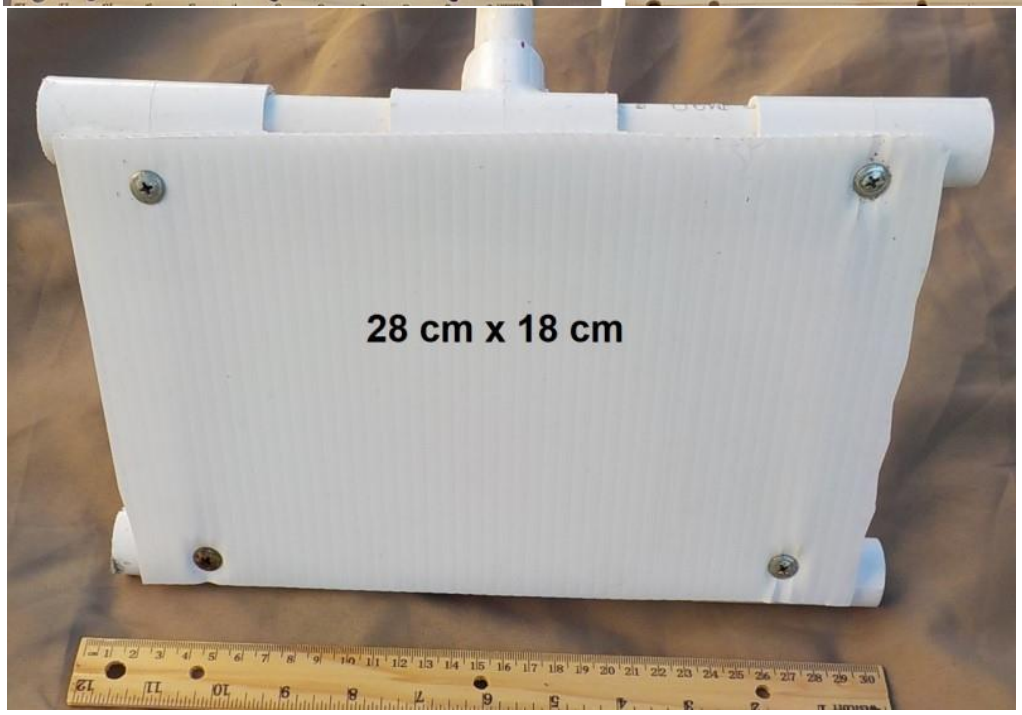


Weight inside the bucket will secure the sample to the pool bottom.

Simulated rock:
The simulated rock is constructed from ½-inch PVC pipe and a 32 cm x 20 cm square of corrugated plastic sheeting. The corrugated plastic sheet is attached to the PVC framework with screws.



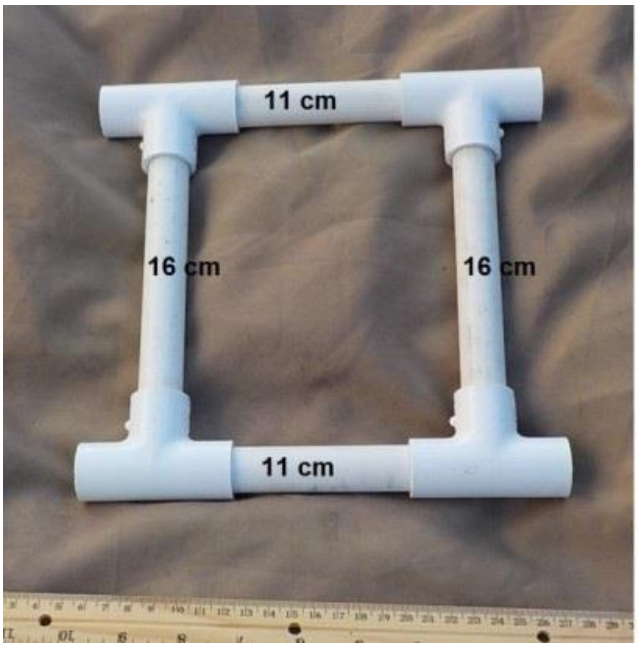


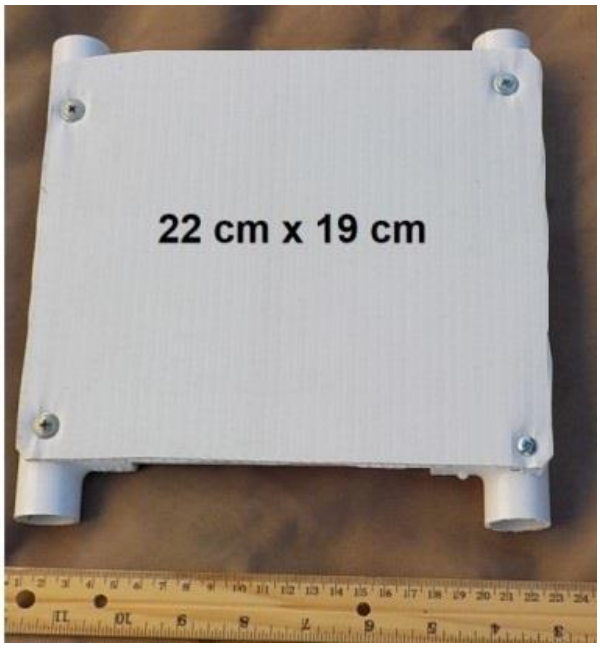


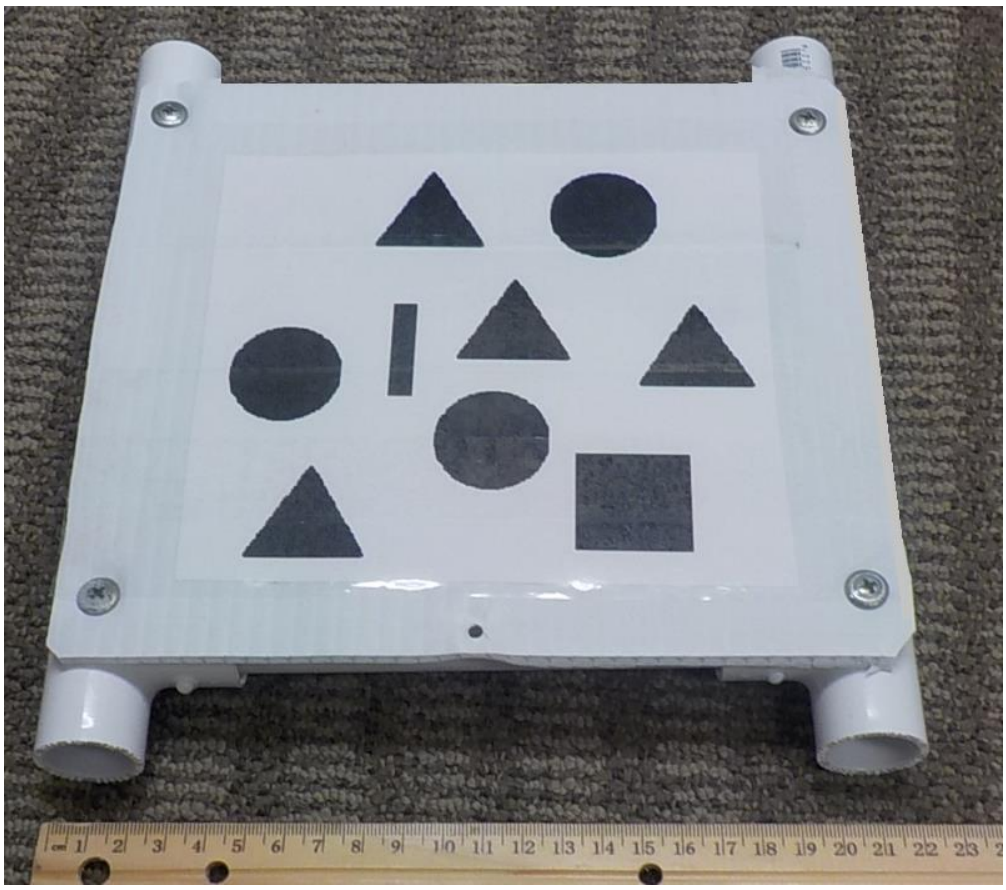
Benthic species:

The benthic species are located on a 22 cm x 19 cm square of corrugated plastic sheeting attached to a PVC framework. The corrugated plastic sheeting is attached to the PVC framework with screws. Rebar inside the ½-inch pipe adds weight and helps to hold the benthic species to the pool bottom. The benthic species are printed on white paper, laminated, and attached to the corrugated plastic sheeting with clear packing tape. More information on what shapes represent what benthic organisms can be found in the EXPLORER Benthic Species Handbook. A benthic species template can be used by

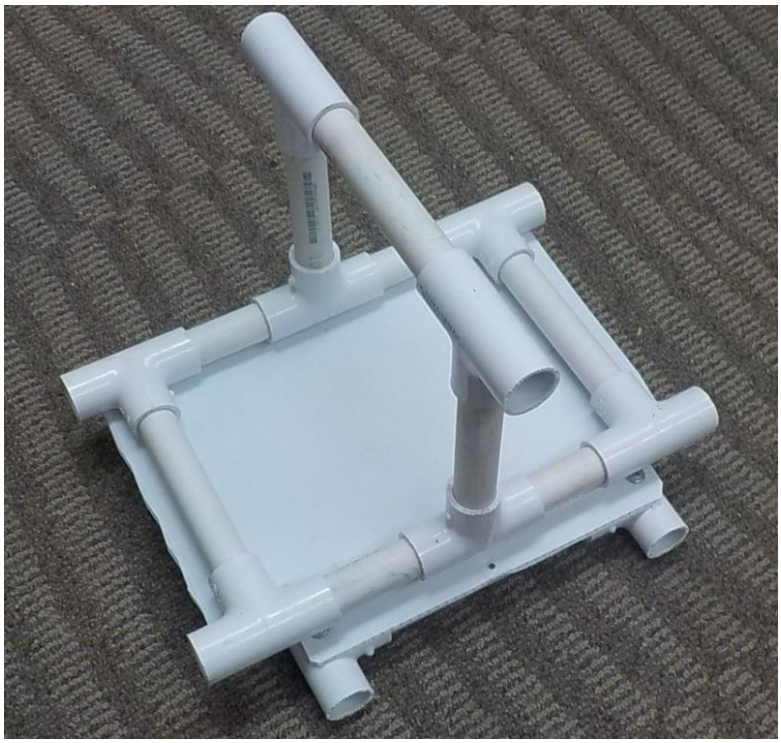
companies to create their own collection of benthic species to print and attach to the corrugated plastic for image recognition tests.







The simulated rock will be positioned on top of the benthic species.

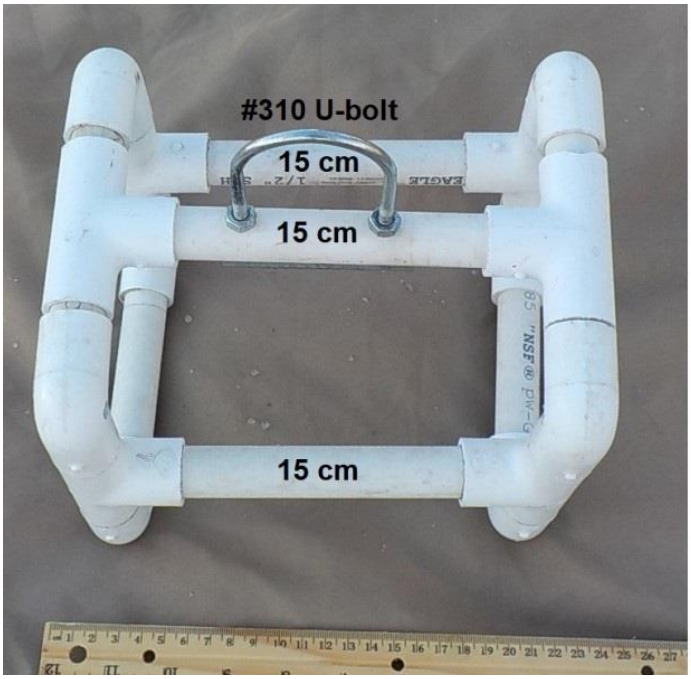


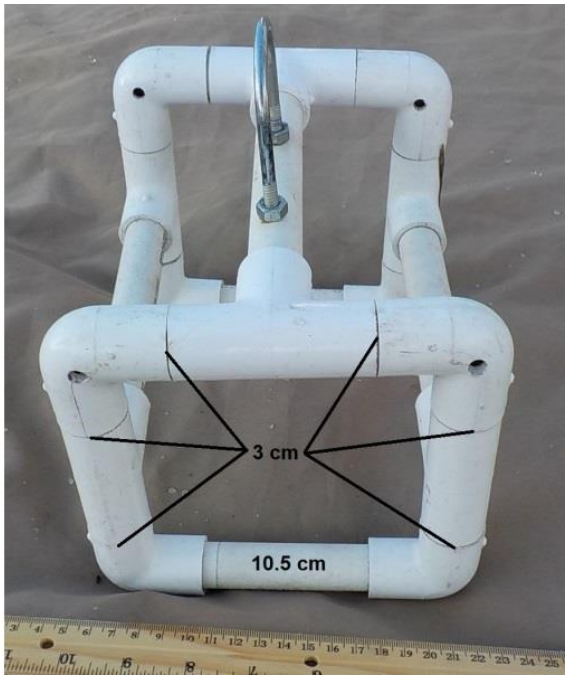
Trout fry:

The trout fry are simulated with rubber fishing lures whose hooks have been removed. Use needle nose pliers to open the split ring holding the treble hook. Remove and discard the hook. Use heavy duty wire cutters to cut the hook on the top of the fish as close to the rubber body as possible. Be safe and wear safety glasses and gloves when removing the hooks.

Degraded tires:
The degraded tires are simulated with 3-inch Corex drain pipe. The Corex pipe is 180 cm long and connected with a 3-inch external cap coupler. Weight inside the drain pipe will achieve the desired negative buoyancy.

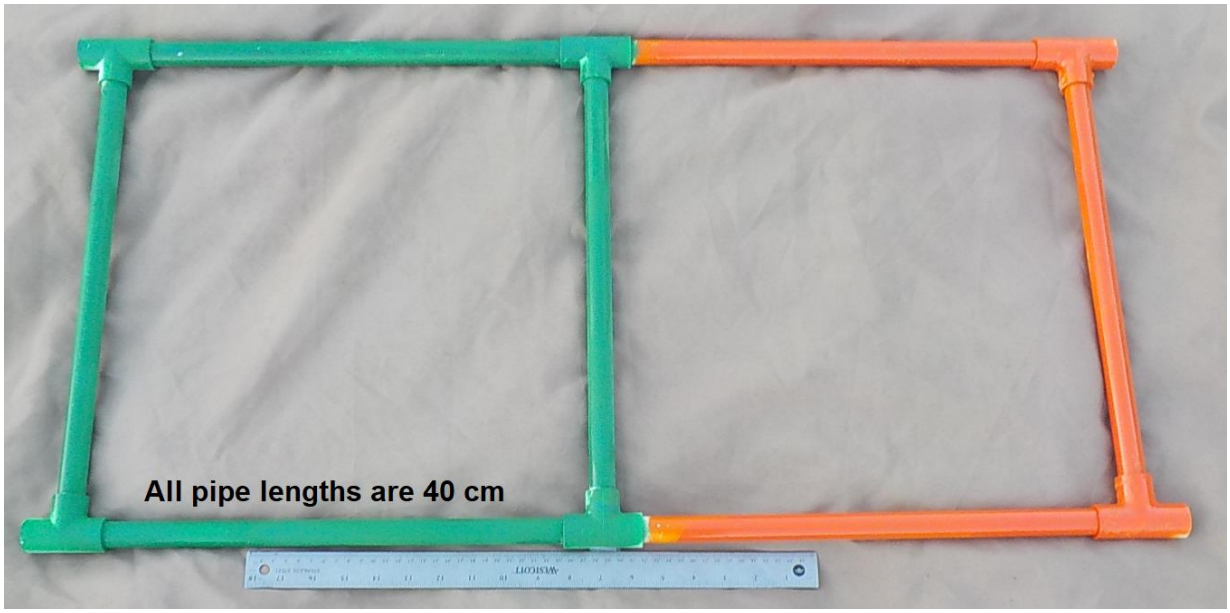
Reef/fish balls:
The reef/fish balls are simulated with ½-inch PVC pipe. A #310 U-bolt will act as a grab point on the fish/reef ball.

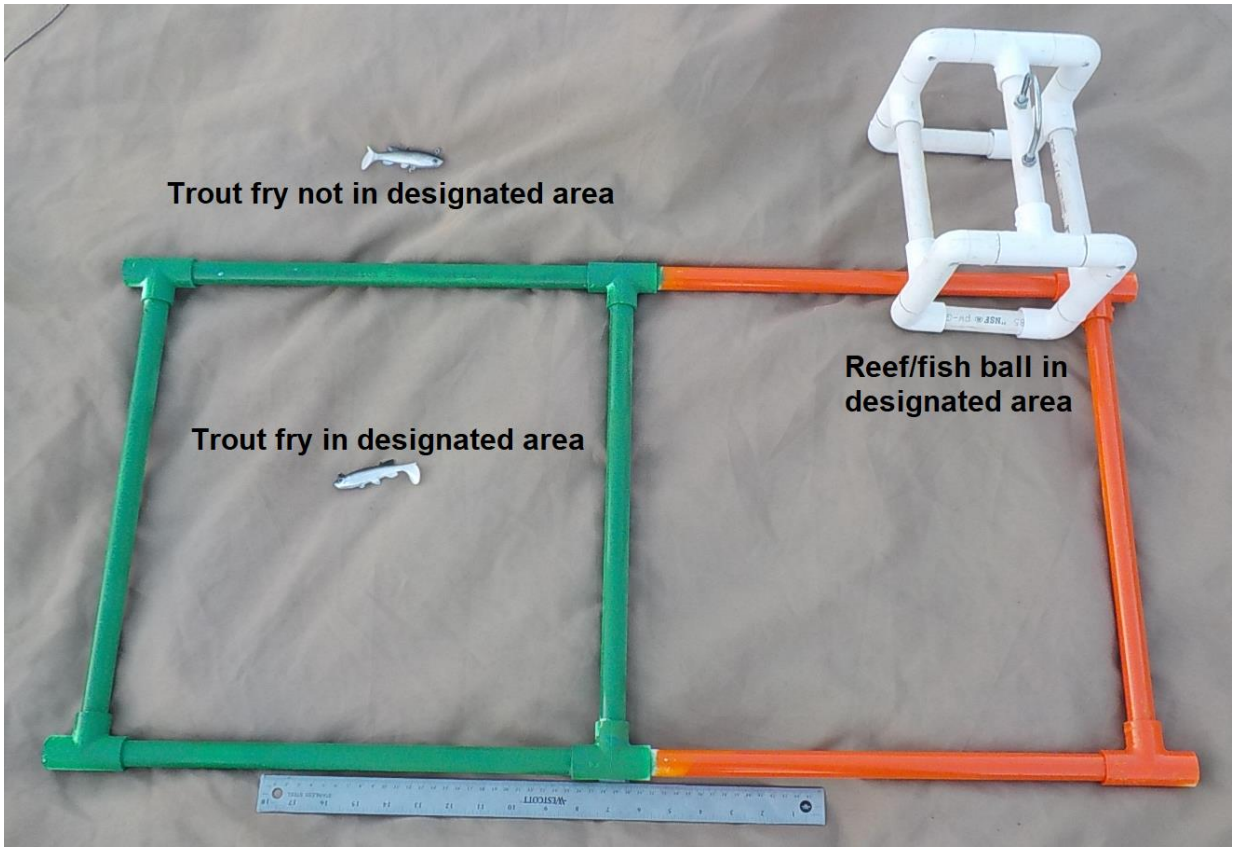




Design note: The reef/fish ball is similar to the Cubesats from the 2017 MATE ROV Competition. An extra 15 cm length of pipe and a U-bolt is added.

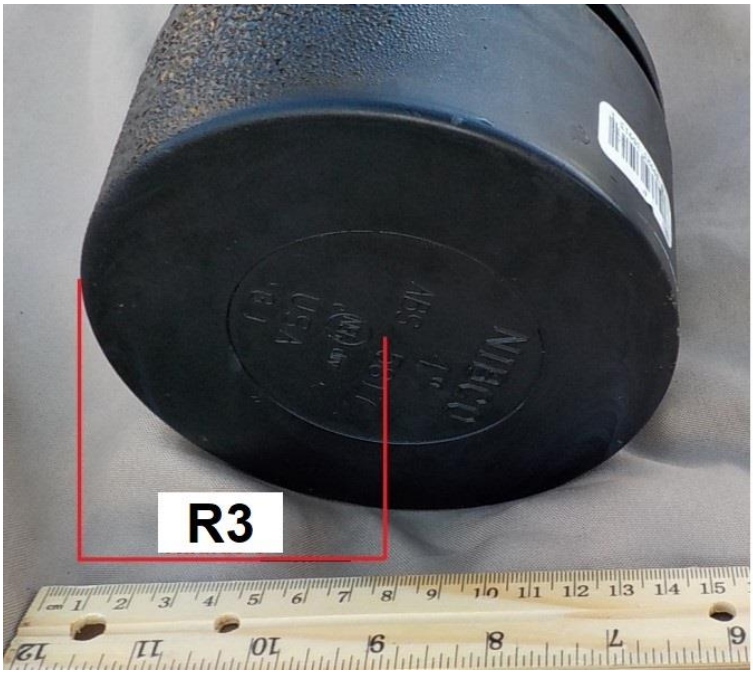
Trout fry and reef/fish ball designated area:
Both the trout fry designated area and the reef/fish ball designated area are constructed from ½-inch PVC pipe. Each square designated area is 40 cm x 40 cm. The designated area for trout fry is painted green. The designated area for the reef/fish ball is painted orange.

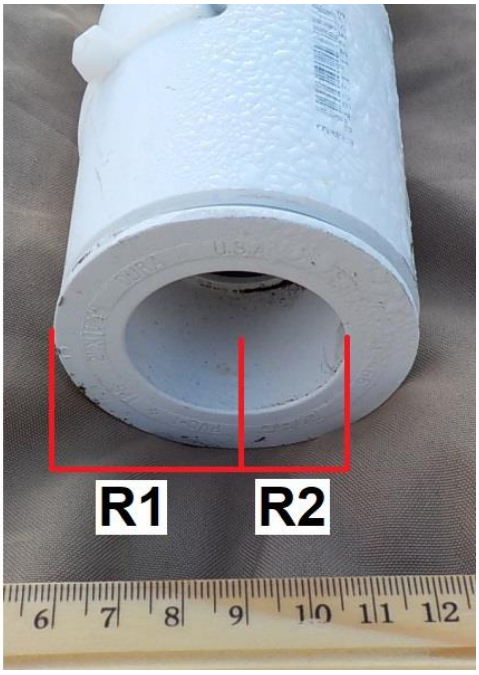




Task 3: Preserving History

Cannon:
The cannon is constructed from various sizes of PVC and/or ABS pipe and connectors/caps.





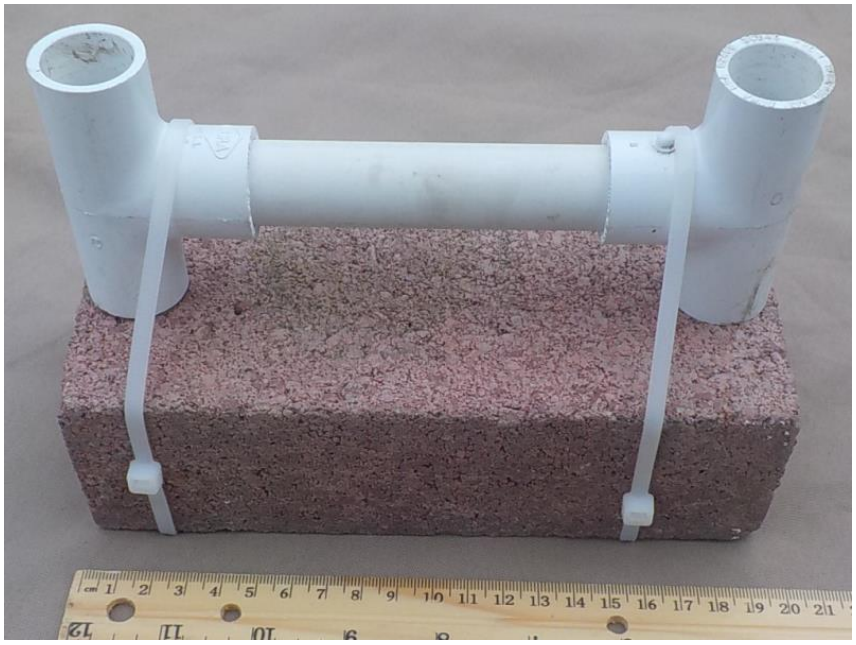
In the above photos, the cannon is constructed from a 4-inch end cap, a 4-inch to 3-inch reducer bushing, 3-inch ABS pipe, a 3-inch to 2-inch ABS adapter, 2-inch pipe, and a 2-inch to 1 ½-inch reducer bushing. Cannons will differ in the sizes of pipe and connectors used.

Cable ties are used to attach weights inside the cannon.

2-inch black letters on the side of the cannon designate the foundry where the cannon was made. Companies will consult the EXPLORER cannon handbook to determine the composition of the cannon.

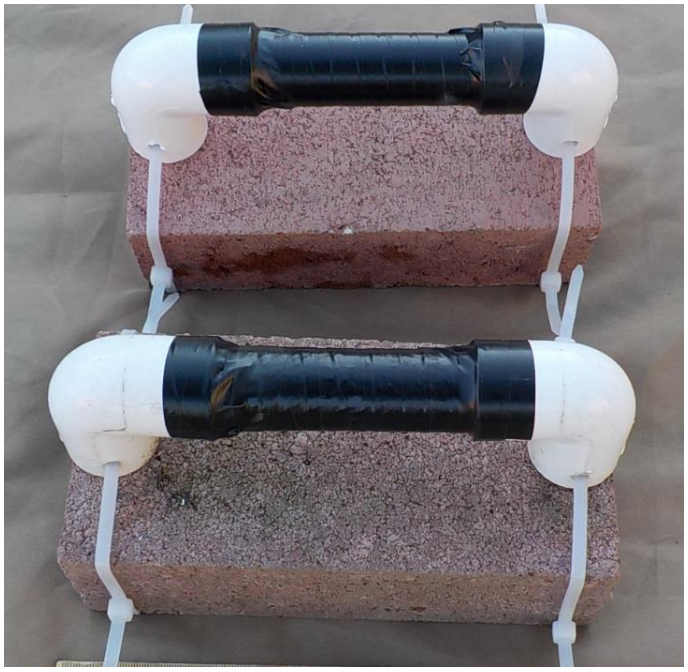
Cannon platforms:
The cannon sits on two platforms to hold it up off the bottom. Each stand is constructed from a 19 cm x 9 cm x 5.5 cm red brick and ½-inch PVC pipe. The ½-inch pipe is secured to the brick with cable ties.


12 cm



Cannon shells:

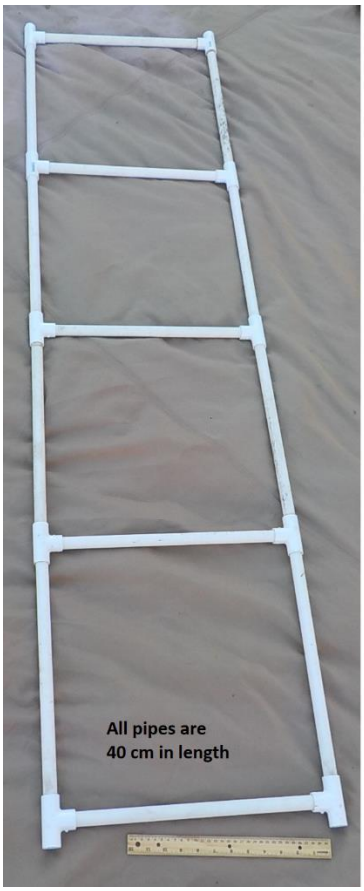
The base of the cannon shell is a 19 cm x 9 cm x 5.5 cm red brick. A cannon shell is simulated by a ¾-inch diameter, 12.5 cm (5-inch) length of galvanized steel pipe. The non-metal debris is simulated by a ¾-inch diameter, 12.5 cm (5-inch) length of PVC pipe. ¾-inch PVC elbows are attached to each end of both the metal and PVC pipes. The pipes are completely covered in black plastic tape. Cable ties are used to secure the pipe to the brick.

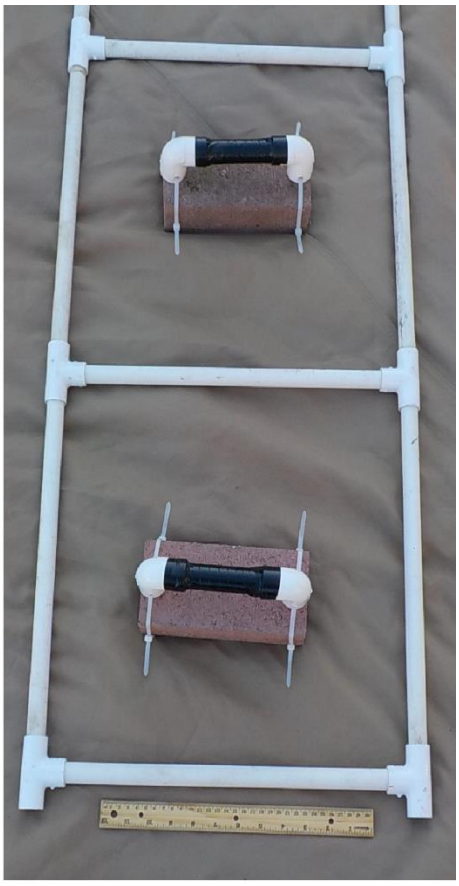


Design note: The cannon shells are from the 2012 competition.

Cannon shell grid:

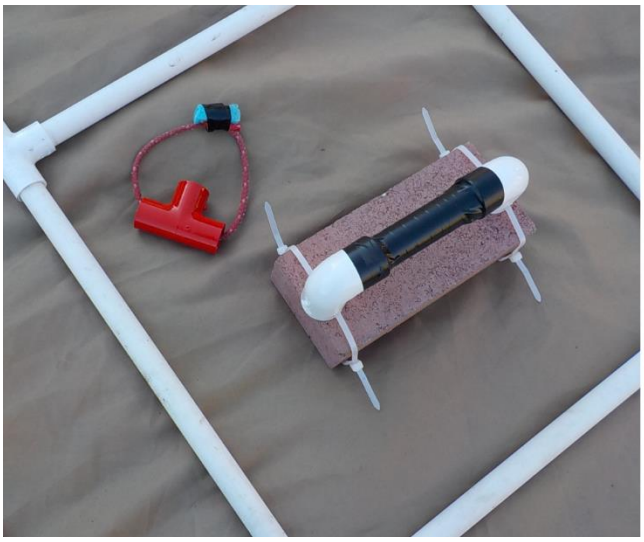
The grid is constructed from ½-inch PVC pipe. All pipe lengths are 40 cm.

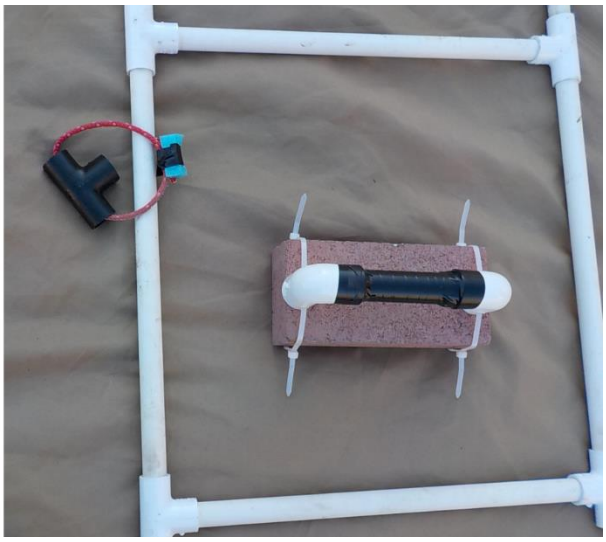




Cannon shell markers:

Markers are constructed from ½-inch PVC tees painted red and black. A 40 cm length of rope (colors may vary) is attached to each tee as a grab loop. Attach a small amount of flotation to the rope to ensure that the rope floats in the water.

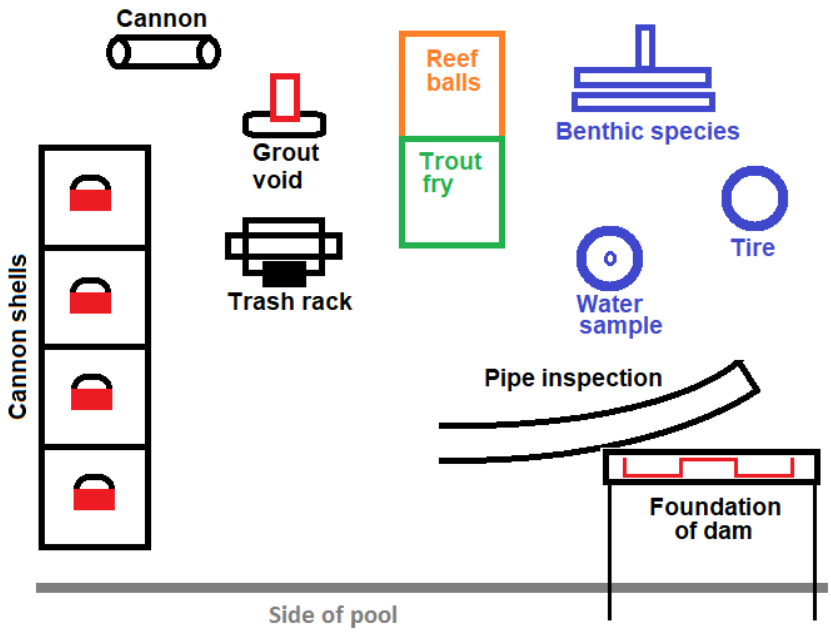




The red marker is successfully marking a metal object. The black marker is outside the PVC square, so has NOT successfully identified a non-metal object.

EXPLORER class product demonstration set up:

The following is a potential underwater set up for the EXPLORER class product demonstration.



The EXPLORER blank grid map, benthic species handbook, data sheet, and cannon handook are on the surface.

The new trash rack screen, grout, trout fry, reef ball and cannon shell markers are on the surface.

Update Notes:

Updates to text are highlighted in yellow.

January 3, 2019:

Updated photo of water sample on pg. 11. The ¾-inch male adapter was mislabeled as a ½-inch in the photo. ¾-inch PVC fittings are used.